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FERTILIZER SITUATION IN THE UNITED STATES.

LETTER

FROM

THE SECRETARY OF AGRICULTURE,

TRANSMITTING

A REPORT AS TO THE FERTILIZER SITUATION IN THE UNITED STATES.

JANUARY 27, 1916.—Referred to the Committee on Agriculture and Forestry and ordered to be printed.

DEPARTMENT OF AGRICULTURE,
Washington, January 26, 1916.

To the PRESIDENT OF THE SENATE.

In compliance with Senate Resolution No. 65, of January 11, 1916, I have the honor to make the following statement on the fertilizer situation:

There is practically no potash in this country at the present time for fertilizer use. In 1913, when conditions were normal, the country's supply of potash salts came from Germany in the form of muriate of potash 225,000 tons, sulphate of potash 48,000 tons, kainit 467,000 tons, and manure salts 171,000 tons, with a total cost to the farmer of \$20,450,000. Since the outbreak of the war this supply has been entirely cut off. Small quantities of potash which were held over from former years are now priced at from eight to twelve times their normal value. A small quantity, it is believed, is being produced by a fertilizer company from the deposits of alunite in Utah. In December, 1913, the wholesale price of potash (potassium muriate, 80 per cent basis), was \$39 per ton. In December, 1915, the same salt was quoted at from \$480 to \$500 per ton. This price is so high as to render it unprofitable to use this material for agricultural purposes.

The necessity of assuring American agriculture an adequate supply of phosphoric acid at a reasonable price is daily becoming more apparent. Acid phosphate is the basis of nearly all commercial

mixed fertilizers. It is made by the action of sulphuric acid upon phosphate rock. Our available sources of phosphate rock are greater than those of any other nation. The main supply for domestic consumption and for exportation comes from Tennessee, South Carolina and Florida. There exists also vast deposits of phosphate rock in Utah, Wyoming, Montana and Idaho. Large portions of these latter deposits have been withdrawn from private use pending legislation for their utilization and only small amounts have been shipped from these fields.

In 1913, 3,111,221 tons of phosphate rock were produced in this country. Up to that time about one-half of the quantity mined was exported to Europe. The rock in its natural state is not readily absorbed as a plant food. It is made available for this purpose by treatment with sulphuric acid, about 1 ton of the acid being used to a ton of phosphate rock. When thus treated, a superphosphate containing 14 to 18 per cent of water-soluble phosphoric acid is made. The bulk of the sulphuric acid which enters into the manufacture of acid phosphate is made by fertilizer companies. Practically every fertilizer establishment (excepting the cottonseed meal factories) having an annual capacity of 15,000 tons or more operates also a sulphuric-acid plant. The production of sulphuric acid (50° B.) in 1913 amounted to 3,538,980 tons. Under normal conditions approximately one-half of this production would be consumed in the manufacture of acid phosphate, making our annual output of this fertilizer material about 3,500,000 tons. The demand for sulphuric acid, however, is so strong at present for purposes other than the manufacture of fertilizer that the price of the acid has more than quadrupled, having advanced from \$6 to \$25 per ton. Not only are the fertilizer plants making less acid phosphate, but the price of this fertilizer material has nearly doubled during the past year, advancing from \$7 to \$13 per ton wholesale. Any further advance in the price of this material may result in stopping its sale, since it is doubtful if the increase in crops obtained from the usual applications of this material will pay for the cost of the fertilizer.

The potential sources of sulphuric acid in the United States are ample to produce more than double the present annual output. Few of the lead, zinc, or copper smelting companies using sulphid ores have sulphuric acid plants in connection with their smelters. The fumes discharged into the atmosphere by these smelters are sufficient to produce many thousands of tons of sulphuric acid daily. Under normal conditions, the limited market for the acid and the long haul necessary to reach the market have made it commercially impracticable to convert the fumes into sulphuric acid. It is entirely feasible to erect sulphuric-acid plants in connection with the copper, zinc, and lead smelters using sulphid ores. The concentrates of the ores may be roasted in furnaces independent of the smelting plants or the fumes may be delivered direct to the acid chambers.

The nitrogen situation is of less pressing concern. The nitrogenous materials entering into the manufacture of fertilizers in 1913 consisted of the following: Nitrate of soda, 70,000 tons; ammonium sulphate, 215,000 tons; cottonseed meal, 1,000,000 tons; dried blood, 40,000 tons; tankage, 100,000 tons; and fish scrap, 70,000 tons, which cost the farmer \$48,800,000. The following table will show



the difference in wholesale prices of these products between October, 1913, and October, 1915:

| Material. | October, 1913. | October, 1915. |
|-------------------------------|-----------------|-----------------|
| Nitrate of soda.....per ton.. | \$46.00-\$48.00 | \$59.00-\$60.00 |
| Ammonium sulphate.....do... | 62.00 | 68.00 |
| Cottonseed meal.....do..... | 31.94 | 33.77 |
| Dried blood.....per unit.. | 3.15 | 2.85 |
| Tankage.....do..... | 3.125 | 2.30 |
| | a 0.10 | a 0.10 |
| Fish scrap.....do..... | 3.25 | 3.25 |
| | 3.35 | |
| | a 0.10 | a 0.10 |

a Material is also a phosphoric acid carrier, for which 10 cents per unit was quoted.

It would appear from these figures that the United States is in a position of fortunate independence with regard to ammoniates, and the present disturbed conditions have affected the supply but slightly. There has been a certain increase in prices within the last few months, though the present price is but little, if any, higher than that experienced in former years in normal times. The increase in price of these materials can not be attributed exclusively to the present situation, since the trend of the price of nitrogen has been upward for a number of years. This is due to increasing demands made on the organic (vegetable and animal) ammoniates for feeding purposes as well as for fertilizers. The price of ammonium sulphate has risen in recent months, due largely no doubt to the great increase in the price of sulphuric acid, and since the various ammoniates are competitive with each other, this rise is largely responsible for the rise in the price of the others.

Only a small percentage (13 per cent in 1911) of the sodium nitrate imported from Chile enters into the production of fertilizers. Other industries, such as dyestuffs, general chemistry, explosives, etc., consume the balance. Of this small percentage the bulk is used in special brand fertilizers for trucking and greenhouse work. It therefore plays an unimportant part in the American fertilizer industry, and it is not believed that the recent rise in price of the Chilean nitrates has had any material effect upon the price of nitrogenous fertilizer materials.

SUGGESTIONS FOR RELIEVING THE SITUATION.

Little or nothing can be done to relieve the potash situation in time for this spring's planting. It is possible, if immediate steps are taken, that some relief may be offered later in the year. The most promising sources of a supply of potash in the near future in the country are the alunite deposits, mainly in the mountains of Utah, and the giant kelps of the Pacific coast from Lower California to Alaska.

Alunite.—Alunite, a mineral which exists in considerable quantities in Utah and neighboring States, contains about 11 per cent potash. It is decomposed by roasting at a temperature of about 700°, with the evolution of oxids of sulphur, and a residue consisting of alumina and potassium sulphate remains. From this residue the potash salt can be obtained readily by leaching and evaporation.

The process is simple. The fumes liberated can be used to manufacture sulphuric acid. Alumina resulting as a by-product will be suitable for the manufacture of metallic aluminum. One large company has begun the manufacture of potash from alunite and is reported to be making regular shipments of about 20 tons a day. It is understood that another large company is about to begin the erection of the necessary plant for the production of potash from this material.

Giant kelp beds.—An ample supply of potash for the needs of farmers can be obtained from the giant kelp beds. These beds have been surveyed by the Bureau of Soils and a report, accompanied by maps showing in detail their extent and location, recently has been issued.

For utilizing the kelp for the production of fertilizer three methods have been suggested. As a preliminary to any method for its utilization the kelp must be harvested, and this will require harvesting machines and, possibly, barges and tugs, according to the method employed. With the receipt of the wet kelp at the plant it may, first, be dried and ground. In this condition it contains all the salts originally present, which are mainly potassium chloride and sodium chloride. This material has mechanical properties which admit of its use in mixed fertilizers without further treatment. Kilns for drying the kelp and mills for grinding the dried material will be required with conveyors and transmission and the necessary storage space.

Second, since the freight on so large a bulk of material as the dried and ground kelp will constitute would be heavy, in practice it may prove more feasible to employ the method of destructive distillation, yielding purer salts and by-products. For this purpose a machine will be required of the general type of a continuous coke oven which will take the dried material and yield a charcoal and by-products. The charcoal contains the salts, mainly potassium, with some sodium, which may be recovered by leaching and subsequent evaporation. Among the by-products will be combustible gas, which can be used in the dryers, the nitrogen evolved as ammonia and recovered as ammonium sulphate, and tarry and other substances.

Third, the wet kelp may be cut into small pieces and treated in such a manner as to coagulate the organic matter so that it can be filtered. The resulting juices are then evaporated to produce potassium and sodium salts. The residue, containing small percentages of potash and nitrogen, is available for drying and use as a fertilizer. For this method vats and filter presses would be required.

Several commercial concerns have begun operations for the manufacture of potash from kelp. Only one of these, so far as known, is interested in the production for fertilizer purposes, and from the best data obtainable at this time this concern contemplates handling about 450 tons of wet kelp per day, producing about 50 tons of dried ground kelp per day.

The title to the kelp beds is in the hands of the States along whose shores they occur, and the lack of legislation permitting the definite control of given areas discourages the individual investor from entering the field of production. Furthermore, at the present price of potash, private investors entering the field could not be expected to dispose of their product for fertilizing purposes.

There are numerous problems connected with the possible development of an industry for the production of potash from kelp which need to be worked out, and these problems can not be satisfactorily solved except in a plant operating on a commercial scale. The Bureau of Soils has already conducted somewhat elaborate laboratory investigations of the problem, and is prepared to erect a plant at short notice designed to determine the best methods for harvesting and treating the kelp for the production of fertilizer ingredients. The solution of these problems would render the American farmer independent of foreign sources of potash and would mean the establishment of an important American industry. A plant capable of handling 500 tons of wet kelp per day and demonstrating the possibility of its utilization for fertilizer purposes will require an outlay of about \$100,000. A further appropriation of \$50,000 for additional equipment will permit experimentation with all three methods outlined above. In addition, \$25,000 working capital would be required, with the provision that the products should be disposed of at the market price and the proceeds returned to the plant for operating expenses.

For the immediate relief of the phosphate situation, which is dependent upon the price of sulphuric acid, the production of an increased supply of acid is essential. Under normal conditions the supply of sulphuric acid in this country is fully adequate to meet the demand, and the private investor is loath to put money into a plant for the production of acid under conditions which are abnormal and which may cease at any time. There is, however, the possibility of the use of hydroelectric energy in the electric furnace for the treatment of phosphate rock to produce phosphoric acid. The Bureau of Soils has conducted some experiments on a laboratory scale and has secured data sufficient to warrant larger experiments on a commercial scale. It is now installing at its Arlington plant equipment to try out on a semicommercial scale methods for producing phosphoric acid and nitrogen products by electric-furnace methods. This process is only commercially feasible where cheap power can be secured. The ordinary price at which hydroelectric power in this country is sold makes the use of this power for fertilizer production by present methods out of the question. There is a possibility of securing water power in the Southern States in proximity to the southern phosphate beds. Most of the developed power in this region is, however, now being used to its full capacity. The Bureau of Soils has ascertained that power can be secured on some of the reclamation projects within reasonable distance from the western phosphate beds, and it is possible that cheap power might be developed within some of the national forests close to the phosphate deposits. There is also a possibility of securing cheap power in the neighborhood of the phosphate beds from private concerns now in operation. The Bureau of Soils is now endeavoring to secure some accurate data on this point. Since the consumption of fertilizers is chiefly in the South Atlantic States, in order to market the western phosphates it is essential that a concentrated product which is sufficiently valuable to stand the cost of transportation be manufactured. This would involve, therefore, the production of either double acid phosphate, phosphoric acid, or salts of phosphoric acid. The possibility of producing in one operation by



electric-furnace methods both a phosphate and nitrogenous fertilizer is now under investigation.

A phosphoric-acid plant, exclusive of the hydraulic and hydroelectric equipment, located in the western fields, to test the possibilities of utilizing the western phosphate beds by the use of hydroelectric power would require an appropriation of approximately \$100,000. For operating expenses for one year \$25,000 would be required, with the provision that the products should be disposed of at the market price and the proceeds returned to the plant for operating expenses.

As a means of increasing the possible supply of nitrogenous fertilizing materials, the Bureau of Soils has investigated the possibility of utilizing the large amount of waste in connection with the salmon fish industry on the Pacific coast and has brought to the attention of the industry the advisability of utilizing this waste for fertilizing materials. The bureau has also investigated the utilization of garbage and other classes of city waste for the manufacture of fertilizer and recently has urged upon the cities the more thorough utilization of these materials. At the same time the bureau has been conducting investigations on a laboratory scale for the purpose of improving the present methods of rendering garbage and with a view to the development of other methods. Likewise the products prepared from city waste are being investigated in the laboratory to determine their fertilizer value.

The production of ammonium sulphate might be largely increased by the use of modern by-product ovens in the coke industry. Ammonium sulphate is the most important of the inorganic ammoniates and only a fraction of the possible production is being manufactured.

The suggested experiments in the use of hydroelectric power in connection with the western phosphates may also lead to important results bearing upon the nitrogen situation. It is a well-known fact that with cheap power the fixation of atmospheric nitrogen for the production of nitrates and cyanamid is commercially possible. The production of carbides, from which cyanamid is manufactured, is covered by a basic patent having eight years yet to run, and if the production of cyanamid is included in the process an operating arrangement with the owners of this patent would be necessary. It is, however, the hope of the Bureau of Soils to develop a process by which the production of nitrogenous products and phosphoric acid may be accomplished in one operation in the same electric furnace and in such a way as not to infringe this or other existing patents. The proposed plant outlined under the discussion of phosphates would have this ultimate object in view. Experiments on a laboratory scale have been conducted for some time by the bureau along this line. The importance of the development of a nitrate industry in this country, because of their use in the preparation of munitions, makes any investigation in this direction of the utmost importance to the country.

With the production of phosphoric acid and ammonia in one operation, the highly concentrated product, ammonium phosphate, can be manufactured, combining the phosphoric acid with a product approximately four times as valuable, which could be put on the market in the East at a reasonable figure despite the long freight haul.

Respectfully,

D. F. HOUSTON, *Secretary.*



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